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COMPUTATION TECHNIQUE FOR COMBAT OPERATIONAL READINESS FLOAT (O--ETC(U)
MAR 77 V C BERGER, B T STONE

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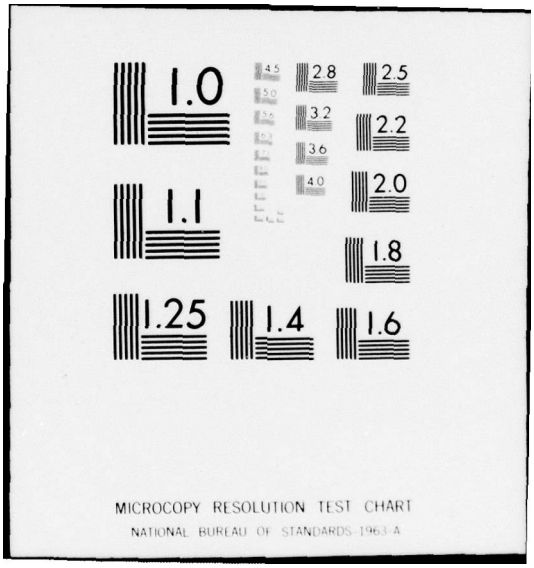
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COMPUTATION TECHNIQUES FOR COMBAT OPERATIONAL READINESS FLOAT (ORF) FACTORS

Valentin C. Berger
Blaine T. Stone

11 March 1977

Final Report

U.S. ARMY AVIATION SYSTEMS COMMAND
Systems Analysis Office
Operational Systems Analysis Division
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St. Louis, Missouri 63166

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Computation, Technique, Combat, Operational, Readiness, Float, Factors

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A technique is demonstrated for computing Operational Readiness Float (ORF) Factors for selected first line aircraft systems. The base period for data used in the study is Jan 68 thru Dec 71, corresponding to RVN combat years.

The technique relates quantitatively flying time rates, the number of maintenance events lasting in excess of AR 750-1 float issue limits, the average duration of those events, and the density of deployed aircraft in RVN, in CONUS, and —>

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20. ABSTRACT

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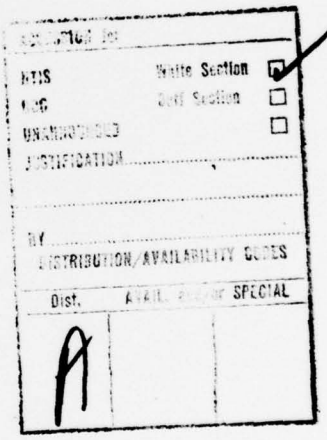
OCONUS outside of RVN. Computed percentages are presented as raw ORF factors suitable for judicious integration with operational experience to yield usable factors approved by the Department of the Army.



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I. BACKGROUND

In previous years, the computation of Operational Readiness Float (ORF) factors has been executed in accordance with the guidance of the May 1972 issue of AR 750-1. In March of 1975, HQ DA tasked AVSCOM to review the 10% ORF factor in use by Army aviation for adequacy and appropriateness. Specifically, DA interest centered on peacetime ORF factors and on ORF factors suitable during mid-intensity combat operations. Required analytical effort was accomplished by AVSCOM's Systems Analysis Office under the direction of AVSCOM's Director of Weapon Systems Management. The results of peacetime ORF factors computation were presented to DARCOM on 5 April 1976, to HQ DA on 6 April 1976, and to the ADUSA(OR) on 24 May 1976.

Subsequently, AVSCOM completed the assignment by computing ORF factors for combat operations, presented these results to DARCOM on 26 July 1976, and to HQ DA and the ADUSA(OR) on 27 July 1976. This report addresses the approach, methodology, and the findings pertinent to combat ORF requirements.

II. METHODOLOGY

The data base used in this study spans a 36-month period, January 1969 thru December 1971, for the CONUS deployment and a 48-month period, January 1968 thru December 1971, for the RVN and OCONUS-LESS RVN deployments of first line rotary-wing and fixed-wing aircraft.

The data employed is extracted from RCS-AMC-130 status and flying time report tapes constructed from DA Form 1352 input (Reference 1). These data elements were computer-processed to yield monthly counts of fleet size, flying hours, availability, field repair occurrences stratified according to specific durations, and other items of information needed for analytical purposes.

Computer-processed information described above was further handled via a computer-slaved graphic display unit. This unit was used to construct traces of significant data during the study time periods, as well as to compute and plot best-fit curves. Selected products of the computer/plotter device were used to prepare vu graphs and are reproduced in this study.

III. APPROACH

The approach followed has been to:

a. Measure the monthly "demand" for ORF transactions in the CONUS, RVN, and OCONUS-LESS RVN predicated upon the guidance of AR 750-1, Chapter 7, Table 7-1 (Reference 2). This guidance is that a repair time limit of 8 days in CONUS and of 12 days OCONUS justifies the issuance of an OR float aircraft to the losing organization. It is assumed that an Issue Priority Designator (IPD) of 1 to 3 governs these transactions in combat operations.

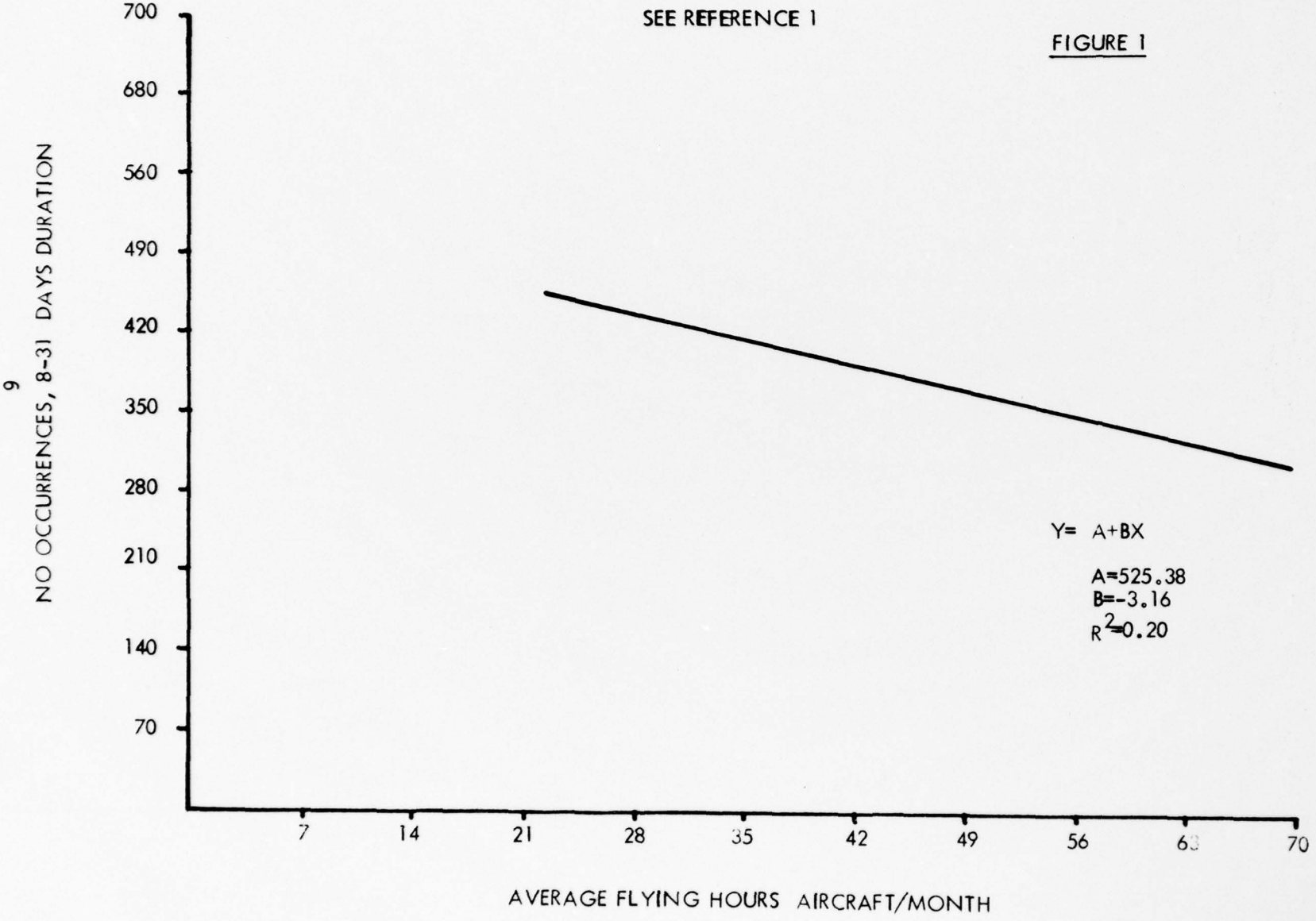
b. Relate the monthly "demand" numbers - which are presumed to equal the number of ORF transactions - to actual average monthly flying hours per aircraft. Relations are displayed in Figure 1, Figure 2, and Figure 3 for the UH-1 (all models). A least-squares curvefit program is used in these Figures to plot traces representing the graphic average of the data points. It is noted that the traces (and their mathematical models) are not suitable for predicting values outside of the actual span of recorded data. The UH-1 traces are typical of all of the first line systems included in this study.

c. In each of the deployment areas, compute the average number of aircraft during the appropriate study period, as well as the average length of (DS+GS+ORG) maintenance downtime, including NORS hours, for each of the first line aircraft fleets shown in Figure 4. Use these average repair times to compute Float Effectiveness Factors (FEF's) by dividing the repair times into the 730 hours of a "standard month." These FEF's indicate the number of "demands" that may be satisfied by one float aircraft each month, during the study periods. Thus, the FEF's are numerical indicators

UH-1 CONUS
JAN 69 - DEC 71

SEE REFERENCE 1

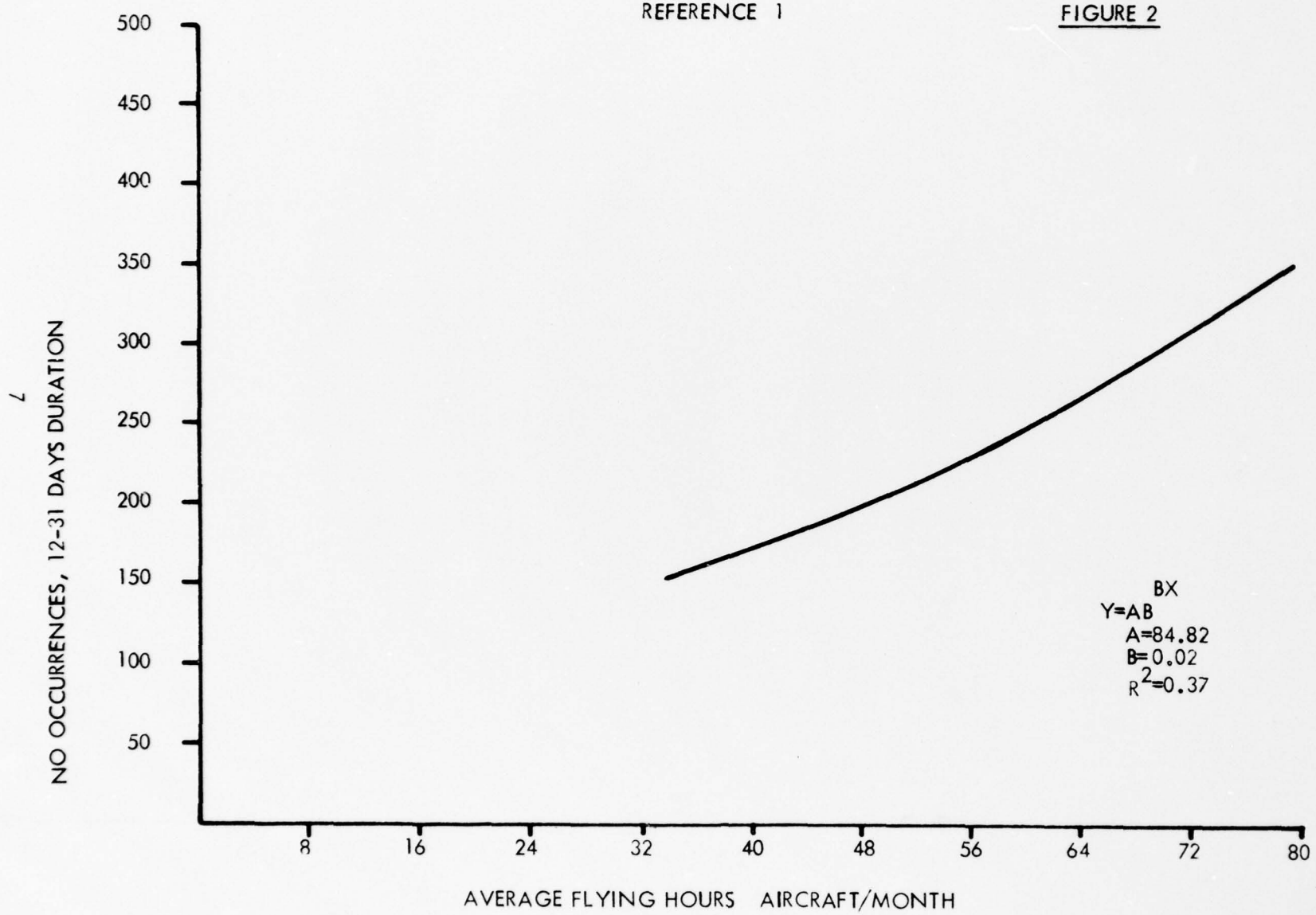
FIGURE 1



UH-1 OCONUS/RVN ONLY
JAN 68 - DEC 71

REFERENCE 1

FIGURE 2



UH-1 OCONUS/RVN EXCLUDED
JAN 68 - DEC 71

SEE REFERENCE 1

FIGURE 3

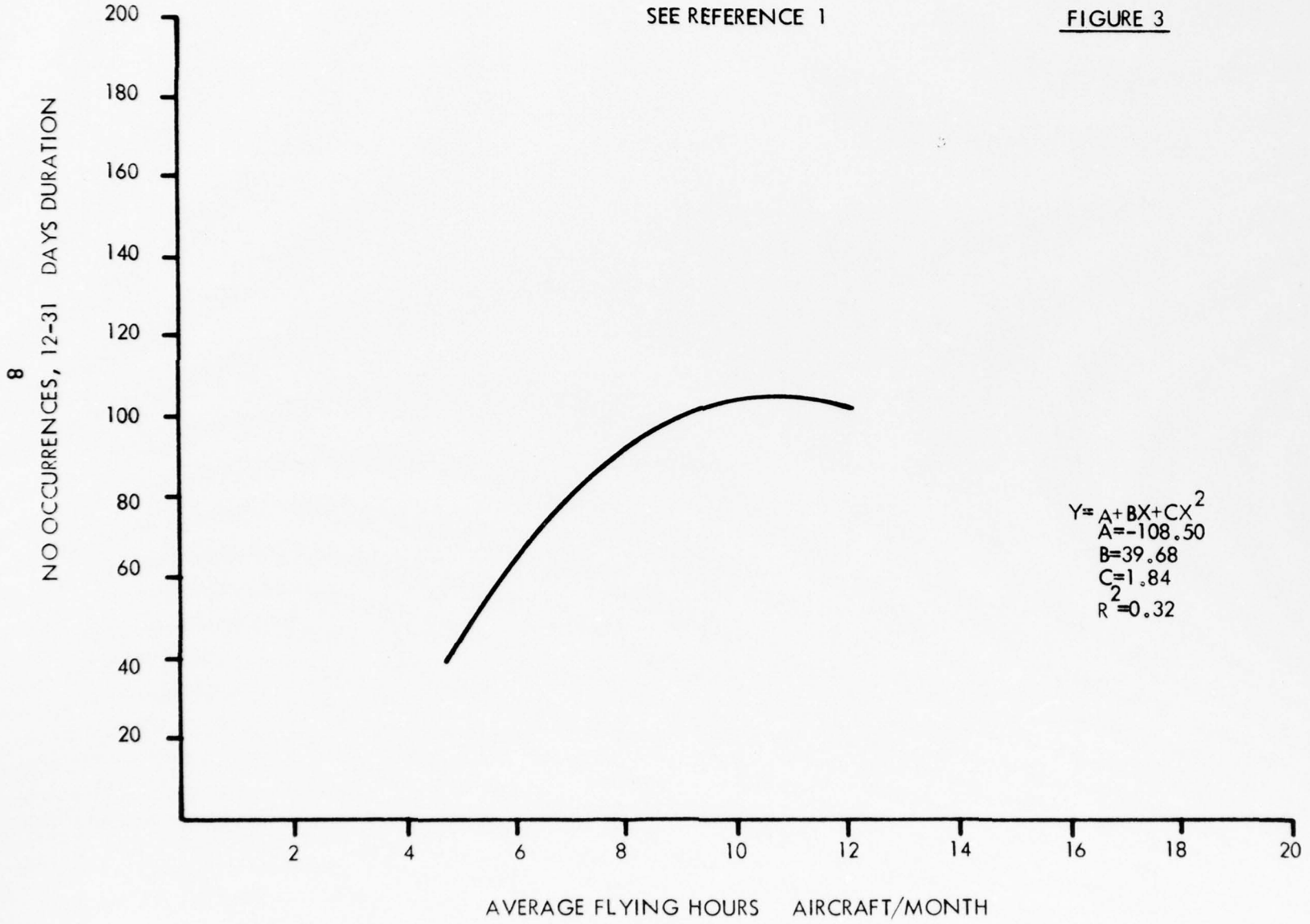


FIGURE 4

FLOAT EFFECTIVENESS FACTORS (FEF's)

DEPLOYMENT	CONUS		RVN		OCONUS-RVN EXCL	
SYSTEM	AVG HRS*	FEF	AVG HRS*	FEF	AVG HRS*	FEF
UH-1	355.8	2.05	427.0	1.71	453.0	1.61
AH-1	343.4	2.13	402.0	1.82	476.0	1.53
OH-58	354.4	2.06	442.0	1.65	447.0	1.63
OH-6	378.1	1.93	419.0	1.74	453.0	1.61
CH-47	356.8	2.05	416.0	1.75	437.0	1.67
CH-54	343.0	2.13	394.0	1.85	454.0	1.61
OV-1	373.5	1.95	424.0	1.72	421.0	1.73
U-21	371.9	1.96	378.0	1.93	418.0	1.61

* AVG HRS = AVERAGE REPAIR DOWNTIME HOURS AT (DS/GS + ORG) LEVELS, PER A/C, DURING 36 MONTHS PERIOD (JAN 69 THRU DEC 71) CONUS, AND DURING 48 MONTHS PERIOD (JAN 68 THRU DEC 71) OCONUS.

$$\text{FLOAT EFFECTIVENESS FACTOR (FEF)} = \frac{730 \text{ HRS/MO}}{\text{AVG HRS/MO OF (NORM + NORS)} \text{ @ ORG + @ DS/GS}}$$

of the "expansion" of the ORF assets supply resulting from repair times averaging a fraction of one "standard month."

d. Using the curvefit traces of 3b above, extract the "number of occurrences" corresponding to the maximum actual monthly flying time per aircraft in each display. This "number of occurrences" is the average monthly number of ORF transactions triggered by matching or exceeding the repair time limits of AR 750-1. For each fleet, and in each of the three deployments, divide the appropriate FEF in the "number of occurrences" extracted from the traces. The resulting numbers represent an absolute ORF "demand" per month.

e. The final step of the computational approach is to relate mathematically each absolute ORF monthly "demand" number to the monthly average number of aircraft in each fleet and deployment area. Expressed as a percentage, each of these ratios is an ORF factor sought in this study. Figures 5, 6, and 7 show the results of steps 3d and 3e, i.e., the ORF factors at maximum actual hours per aircraft per month, consistent with DA guidance and with experience in the time frame of January 1968 thru December 1971.

FIGURE 5

ORF FACTORS

CONUS DATA BASE JAN 69 THRU DEC 71

OCONUS DATA BASE JAN 68 THRU DEC 71

MD A/C FLEET	UH-1		AH-1		OH-58		OH-6	
DEPLOYMENT	CONUS*	RVN**	CONUS*	RVN**	CONUS*	RVN**	CONUS*	RVN**
FEF	2.05	1.71	2.13	1.82	2.06	1.65	1.93	1.74
AVG NUMBER OF A/C	977	2144	65	365	37	220	40	470
MAXIMUM FHRS/A/C/MONTH	70	80	50	92	100	63	50	150
% FLOAT AT MAX. FHRS	15.0%	9.5%	27.0%	8.5%	11.0%	15.5%	18.0%	8.0%

* EVENTS 8 - 31 DAYS
** EVENTS 12 - 31 DAYS

FIGURE 6

ORF FACTORS

CONUS DATA BASE JAN 69 THRU DEC 71

OCONUS DATA BASE JAN 68 THRU DEC 71

MD A/C FLEET	CH-47		CH-54		OV-1		U-21	
DEPLOYMENT	CONUS*	RVN**	CONUS*	RVN**	CONUS*	RVN**	CONUS*	RVN**
FEF	2.05	1.75	2.13	1.85	1.95	1.72	1.96	1.93
AVG NUMBER OF A/C	73	289	6	31	68	87	14	45
MAXIMUM FHRS/A/C/MONTH	50	147	50	54	32	70	70	75
% FLOAT AT MAX. FHRS	23%	9.0%	23.0%	10.5%	15.0%	5.0%	22.0%	10.0%

* EVENTS 8 - 31 DAYS
** EVENTS 12 - 31 DAYS

FIGURE 7

ORF FACTORS

OCONUS DATA BASE JAN 68 THRU DEC 71

MD A/C FLEET	UH-1	AH-1	OH-58	OH-6	CH-47	CH-54	OV-1	U-21
DEPLOYMENT	OCONUS-RVN EXCLUDED **							
FEF	1.61	1.53	1.63	1.61	1.67	1.61	1.73	1.74
AVG NUMBER OF A/C	1108	118	303	184	113	25	93	36
MAXIMUM FHRS/A/C/MONTH	12	5	25	3	12	16	7	49
% FLOAT AT MAX. FHRS	6.0%	5.5%	8.0%	6.5%	7.5%	10.0%	2.0%	11.0%

** EVENTS 12 - 31 DAYS

IV. FINDINGS

Figure 8 statistics are extracted from Figures 4 thru 7. They pertain exclusively to RVN maximum combat hours experience, to RVN average aircraft deployment numbers, and to RVN repair times and resulting FEF values.

FIGURE 8

OCONUS/RVN ORF FACTORS

DATA BASE JAN 68 THRU DEC 71

SYSTEM	AVG NO OF A/C	MAX FHRS/A/C/MO	FEF	ORF
UH-1	2144	80	1.71	9.5%
AH-1	365	92	1.82	8.5%
OH-58	220	63	1.65	15.5%
OH-6	470	150	1.74	8.0%
CH-47	289	147	1.75	9.0%
CH-54	31	54	1.85	10.5%
OV-1	87	70	1.72	5.0%
U-21	45	75	1.93	10.0%

REFERENCES

1. Status and Flying Time Report, RCS-AMC-130, data is computer-processed and shown in Project Number E14QEJ5Ø64A printouts designed by Mr. V. C. Berger, Autovon 698-6911, USAAVSCOM, DRSAV-DO.

2. Army Regulation (AR) 750-1, Maintenance of Supplies and Equipment, "Army Materiel Maintenance Concepts and Policies", 15 June 1972. (Chapter 7, Maintenance Float Support).

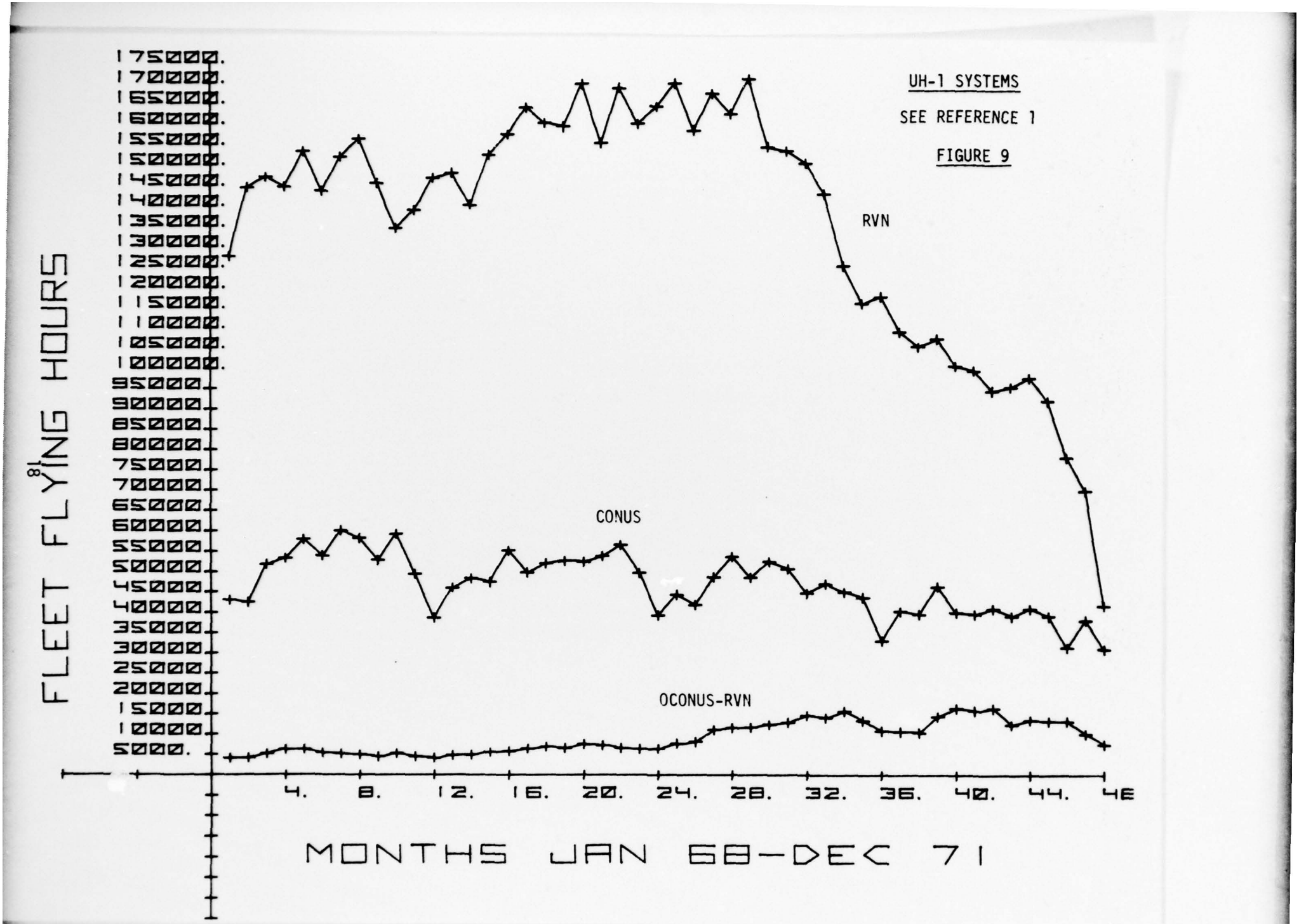
APPENDIX

The Appendix of this report includes:

a. Figure 9, Fleet Flying Hours traces during the period of study for UH-1 (all models) aircraft, and

b. Figures 10, 11, and 12, showing, respectively, the traces of actual and DA Standard Operational Readiness (percentage) rates for the UH-1 systems in CONUS, RVN, and OCONUS-RVN EXCLUDED.

These machine-generated traces are typical of plots prepared for each of the first line R/W and F/W aircraft systems examined. The availability plots demonstrate that UH-1 systems availability in RVN substantially met or exceeded the 74% DA standard. This fact is interpreted as evidence that the 10% ORF factor employed by DA and the 9.5% factor computed by AVSCOM (Figure 8) are in close accord, and that the float assets actually provided in RVN supported combat operations adequately.


UH-1 SYSTEMS
SEE REFERENCE 1
FIGURE 9
RVN
CONUS
OCONUS-RVN
FLEET FLYING HOURS
MONTHS JAN 68-DEC 71
175000.
170000.
165000.
160000.
155000.
150000.
145000.
140000.
135000.
130000.
125000.
120000.
115000.
110000.
105000.
100000.
95000
90000
85000
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
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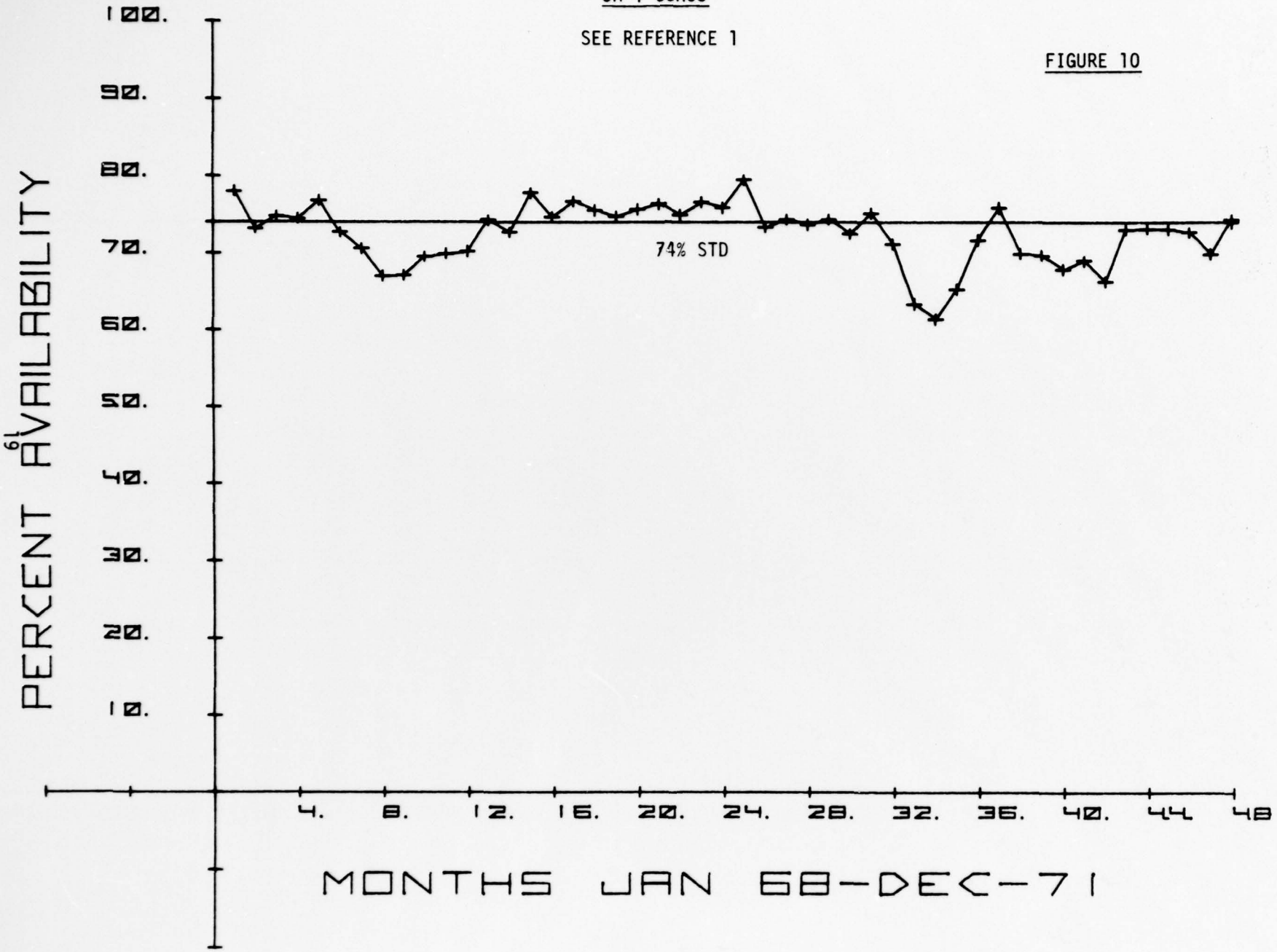
10000
5000.
4.
8.
12.
16.
20.
24.
28.
32.
36.
40.
44.

UH-1 CONUS

SEE REFERENCE 1

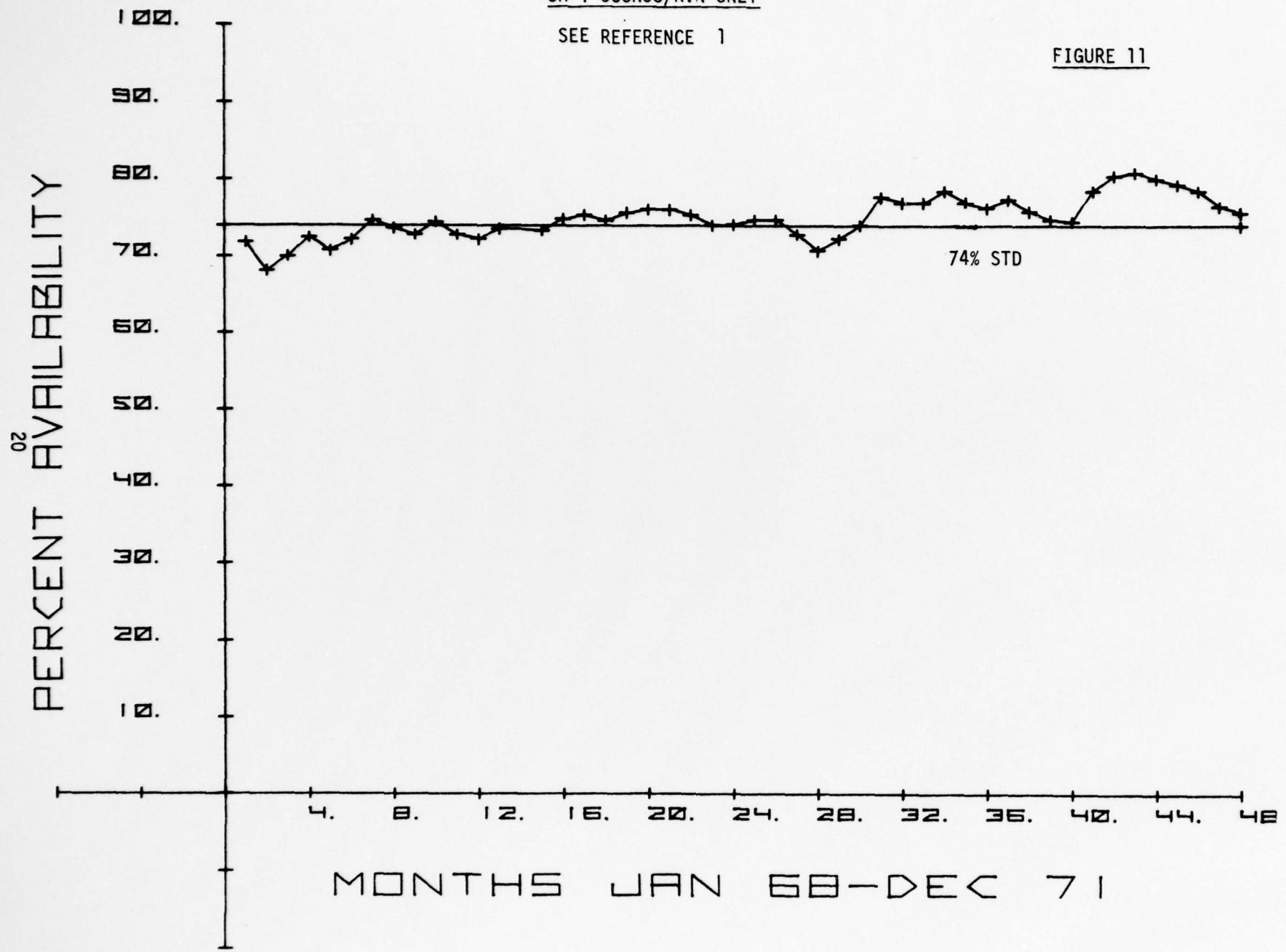
FIGURE 10



UH-1 OCONUS/RVN ONLY

SEE REFERENCE 1

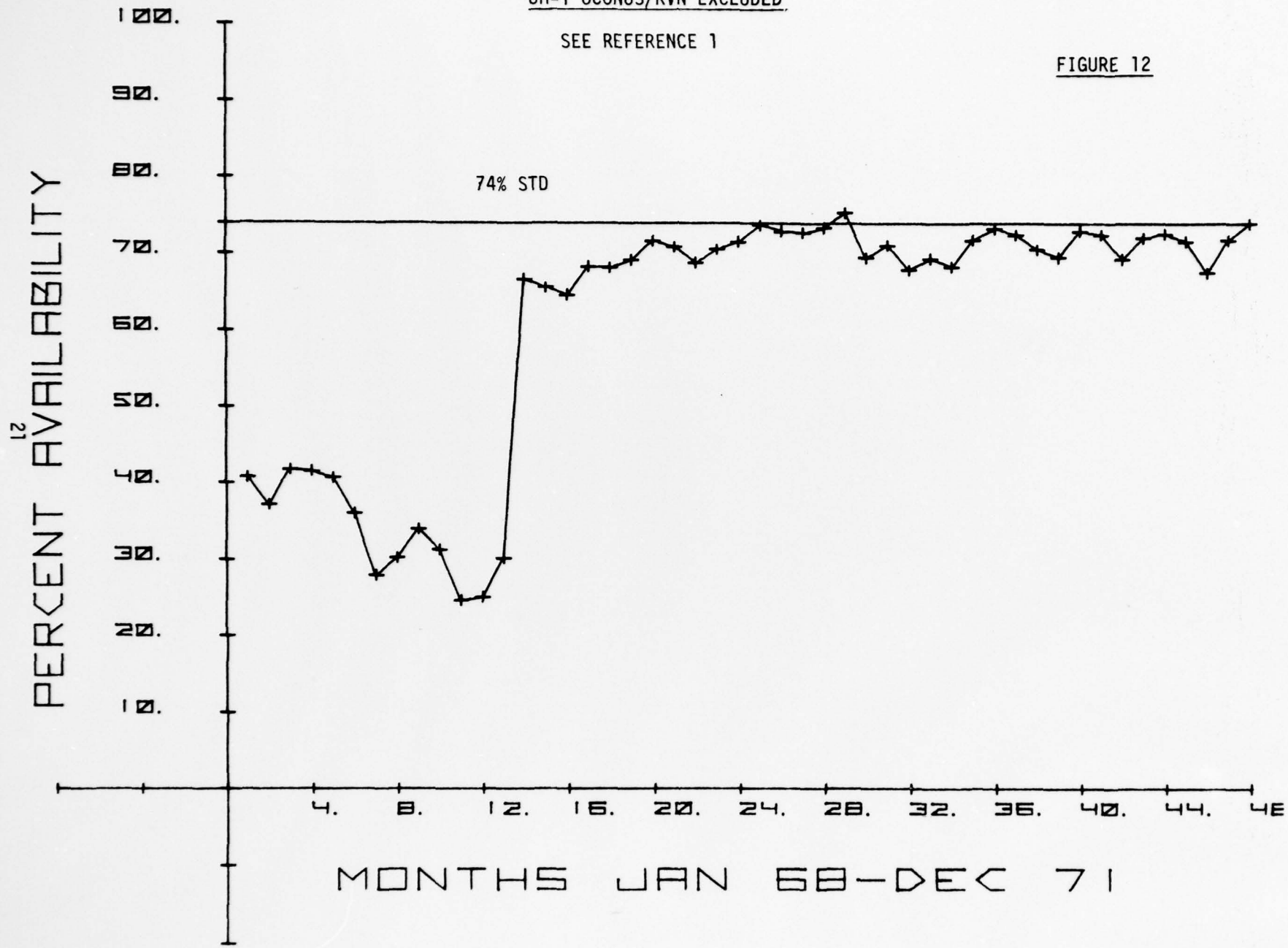
FIGURE 11



UH-1 OCONUS/RVN EXCLUDED

SEE REFERENCE 1

FIGURE 12



ACRONYMS

A/C:	Aircraft, all types
ADUSA (OR):	Assistant Deputy Under Secretary of the Army (Operations Research)
AR:	Army Regulations
AVSCOM:	Aviation Systems Command
CONUS:	Continental United States
DA:	Department of the Army
DARCOM:	(U.S. Army) Development And Readiness Command
DS:	Direct Support (Maintenance)
FEF:	Float Effectiveness Factor
F/W	Fixed Wing
GS:	General Support (Maintenance)
HQ DA:	Headquarters, DA
MD:	Model Designated (Series, Aircraft)
NORM:	Not Operationally Ready, Maintenance
NORS:	Not Operationally Ready, Supply
OCONUS:	Outside (of) Continental United States
ORF:	Operational Readiness Float
ORG:	Organizational (Unit Maintenance)
RVN:	Republic of Vietnam
R/W	Rotary Wing
USAAVSCOM:	U.S. Army AVSCOM

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